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SUMMER HABITAT USE BY COLUMBIAN SHARP-TAILED GROUSE IN WESTERN IDAHO

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ABSTRACT—We studied summer habitat use by Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*) in western Idaho during 1983–85. Vegetative and topographic measurements were recorded at 716 locations of 15 radio-tagged grouse and at 180 random sites within the major vegetation/cover types in the study area. The mean size of summer home ranges was 1.87 ± 1.14 km^2. Of eight cover types identified in the study area, individual grouse used the big sagebrush (*Artemisia tridentata*) cover type more than or in proportion to availability, the low sagebrush (*A. arbuscula*) type in proportion to availability, and avoided the shrubby eriogonum (*Eriogonum* spp.) type. Characteristics of the big sagebrush cover type that Sharp-tailed Grouse preferred include moderate vegetative cover, high plant species diversity, and high structural diversity. Grouse used areas of dense cover (i.e., mountain shrub and riparian cover types) primarily for escape cover. Compared with random sites, grouse selected areas with (1) greater horizontal and vertical cover, (2) greater canopy coverage of forbs typically decreased by livestock grazing, (3) greater density and canopy coverage of arrowleaf balsamroot (*Balsamorhiza sagittata*), and (4) greater canopy coverage of bluebunch wheatgrass (*Agropyron spicatum*) in the big sagebrush cover type in 1984 and the low sagebrush cover type in 1985. The importance of the native perennials arrowleaf balsamroot and bluebunch wheatgrass became apparent during a drought year when many exotic annuals dried up and provided no cover. Overall, grouse selected vegetative communities that were least modified by livestock grazing.

Key words: Tympanuchus phasianellus columbianus, *Columbian Sharp-tailed Grouse, Idaho, summer habitat characteristics, management.*

Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*) have declined in both numbers and distribution since European settlement, currently occupying <10% of their former range (Miller and Graul 1980). Degradation of native habitat by livestock grazing and agriculture are thought to be major factors in this decline (Yocom 1952, Aldrich 1963, Zeigler 1979). Overgrazing reduced bunchgrasses and perennial forbs that are important components of nesting and brood-rearing habitat (Yocom 1952, Jewett et al. 1953, Klott and Lindzey 1990). Conversion of range to cropland destroyed nesting and brood-rearing habitat and deciduous shrubs that are critical for winter food and escape cover (Zeigler 1979, Giesen 1987, Marks and Marks 1988). As a result, Columbian Sharp-tailed Grouse were designated as a candidate species for listing as federally threatened/endangered (Federal Register 1989).

Quantitative information on home range size and habitat preferences of Columbian Sharp-tailed Grouse throughout their range is lacking, especially data based on radio-tagged individuals during the summer reproductive period (see Klott and Lindzey 1990). We studied Columbian sharptails in areas with eight vegetation/cover types. The primary objective of our study was to provide information on summer habitat preferences by Columbian Sharp-tailed Grouse.

STUDY AREA

The 2000-ha study area is 23 km north of Weiser in Washington County, Idaho. Elevation ranges from 970 to 1188 m. Annual precipitation averages 39 cm. The springs and summers of 1983 and 1984 were relatively cool and wet, whereas those of 1985 were unusually hot and dry. Sharp-tailed Grouse had not been hunted in the study area since 1974.

Vegetation is characteristic of a shrubsteppe community (Marks and Marks 1987a). The greatest proportion of the study area (40%) was occupied by the big sagebrush (*Artemesia tridentata*) cover type; low sagebrush (*A. arbuscula*) and shrubby eriogonum (*Eriogonum*

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sphaerocephalum and *E. thymoides*) types occupied 21 and 20%, respectively. The remaining 19% of the study area was occupied by five other cover types (see below).

The big sagebrush cover type was dominated by big sagebrush, with lesser amounts of bitterbrush (*Purshia tridentata*) and low sagebrush. The greatest canopy coverage of bluebunch wheatgrass (*Agropyron spicatum*) was found in this cover type; arrowleaf balsamroot (*Balsamorhiza sagittata*) was the dominant forb. Bulbous bluegrass was the most common herbaceous plant in the understory of the low sagebrush cover type with lesser amounts of willoweed (*Epilobium paniculatum*), bluebunch wheatgrass, and Sandberg's bluegrass (*Poa sandbergii*). The herbaceous layer of the shrubby eriogonum cover type was relatively sparse and dominated by Sandberg's bluegrass. The mountain shrub cover type occurred in dense patches on hillsides; common species were bittercherry (*Prunus emarginatus*), common chokecherry (*P. virginiana*), snowbrush ceanothus (*Ceanothus velutinus*), and Saskatoon serviceberry (*Amelanchier alnifolia*). The shrub layer of the bitterbrush (*Purshia tridentata*) cover type was almost exclusively bitterbrush, while the herbaceous layer was similar to that found in the big sagebrush type. Riparian vegetation was dominated by Douglas hawthorn (*Crataegus douglasii*), with lesser amounts of willow (*Salix* spp.) and Woods rose (*Rosa woodsii*). Bulbous bluegrass (*Poa bulbosa*), an exotic grass, was widespread throughout the study area. Plant nomenclature follows Hitchcock and Cronquist (1976).

Two vegetation types were almost exclusively comprised of nonnative vegetation. A small portion of the study area contained agriculture, composed of dryland wheat and barley, and monocultures of intermediate wheatgrass (*Agropyron intermedium*) seedings.

The study area was grazed by livestock since at least 1900. Before about 1940, large bands of sheep were driven through the area. Since then, the major land use in the study area has been cattle grazing. No livestock grazing occurred during this study.

METHODS

Trapping and Monitoring

Grouse were captured on dancing grounds using funnel traps, mist nets, and drop nets. Sex was determined by examination of crown feathers (Henderson et al. 1967) and age by examination of outer primaries (Ammann 1944). Thirty-eight grouse (28 males and 10 females) of 46 captured were fitted with solar-powered radio transmitters attached to Herculite ponchos (Marks and Marks 1987b). Radios weighed between 13.5 and 14.5 g. Fifteen (13 males and 2 females) grouse provided data for home range and microhabitat analyses. The other 23 grouse with radios were relocated for two months or less as a result of mortality (Marks and Marks 1987b) or dispersal from the study area. Data from these birds were used in the microhabitat analyses but not in the calculation of home range size. Sample sizes were not large enough to compare habitat use or home range size between male and female grouse.

Radio-tagged grouse were monitored from May to September 1983–85. Each time a grouse was located, it was flushed (hereafter these locations are called flush sites). Flush sites served as focal points for habitat sampling and for calculation of home ranges. Grouse were located throughout the day and locations were stratified into four time intervals: sunrise to 0800, 0801 to 1100, 1101 to 1700, and 1701 to sunset. On average, each radio-tagged bird was flushed four days a week, once in each of the four time intervals.

Habitat Sampling

The study area boundary was determined by grouse movements during 1983. Cover types were digitized and areas calculated for each type using GEOSCAN (Software Designs 1984), a geographic information program. Flush sites were plotted and home range sizes (Mohr 1947) were calculated using the computer program TELDAY (Lonner and Burkhalter 1986).

Use vs. availability of cover types (i.e., macrohabitat) was assessed by (1) using the proportion of cover types within each bird's home range, and (2) using the proportion of cover types within a 1.2-km radius of the dancing ground at which each bird was captured. The 1.2-km radius around each of three dancing grounds (upper, middle, and lower) encompassed 90% of all grouse locations. Flush sites within 50 m of a dancing ground during the spring and autumn display periods were omitted from macrohabitat analyses.

We measured vegetation at each flush site (i.e., microhabitat) to estimate plant species

composition, frequency, percent canopy coverage, and bare ground using a 20 × 50-cm frame (Daubenmire 1959). Five frames were read at each flush site: one at the approximate center and one in each of the four compass directions at randomly chosen distances of 2, 4, 6, or 8 m from the center location. Vertical structure of the vegetation was evaluated by a cover board that was a 16.5 × 49.5-cm rectangle. The cover board was placed at the center of the flush site and read twice from 5 m away in each of the four compass directions while the observer was prone and standing, respectively. A total reading of 150 squares was possible from each compass direction. In total, five canopy coverage and four cover board measures were taken at each site. Other variables recorded at flush sites included (1) cover type, (2) distance to water, (3) percentage of slope, (4) distance to nearest riparian or mountain shrub cover type, and (5) cover type where flushed grouse landed (landing site).

We recorded vegetative and topographic measurements at randomly located sites to assess microhabitat availability in the cover types used most by grouse. Habitat characteristics were sampled with similar methods as described at flush sites. A total of 180 random sites were sampled during the study, 30 each month during May through July in 1984 and 1985. The number of random sites located in each cover type was based on the percentage of area occupied by that cover type in the study area. Canopy coverage and cover board readings were recorded at the origin and at points every 10 paces along a straight line until 20 readings were completed. Slope and distance to the nearest mountain shrub or riparian cover type were recorded only at the first, tenth, and twentieth frames of each random site.

Data Analysis

Data were analyzed with the Statistical Analysis System (SAS Institute, Inc. 1982). Use-availability analyses of cover types were conducted with chi-square goodness of fit tests (Neu et al. 1974) and Bonferroni z-tests (Byers et al. 1984). Data were analyzed separately for each year and pooled when differences were not significant. For analyses of canopy coverage, each plant species was placed into one of 10 categories: (1) big sagebrush, (2) low sagebrush, (3) bitterbrush, (4) other shrubs, (5) arrowleaf balsamroot, (6) other composites, (7) non-composite forbs, (8) bluebunch wheatgrass, (9) bulbous bluegrass, and (10) other grasses. Non-parametric statistics (Mann-Whitney *U*- and Kruskal-Wallis tests) were used to analyze canopy coverage and vertical structure because these data were not normally distributed (Conover 1980). Vegetative measurements at flush sites from May through July were combined by cover type and month for comparisons with data collected at random sites for the same period. All multiple comparisons were computed with Tukey tests (Zar 1974). The Shannon-Wiener index was used to calculate plant species diversity (Hill 1973). Proportions entered into the diversity formula were derived from the total number of plant species occurrences within the frames used to estimate canopy coverage. The significance level for all tests was $P \leq .05$, and all tests of means were two-tailed. Means are followed by ± one standard deviation.

RESULTS

Home Ranges and Macrohabitat Selection

The mean size of summer home ranges was 1.87 ± 1.14 km^2 ($N = 15$, range = 36–68 locations per grouse). Based on habitats within home ranges, three trends emerged from the use-availability analysis of cover types: (1) grouse used the big sagebrush cover type more than or in proportion to availability, (2) the low sagebrush cover type was used in proportion to availability, and (3) the shrubby eriogonum and intermediate wheatgrass cover types were avoided (Table 1). These trends were similar whether use-availability was assessed within estimated home ranges or within a fixed radius around the upper and lower dancing grounds (Table 1). In addition, a single grouse from the middle dancing ground used the big sagebrush cover type more than that expected by chance within its home range and the fixed radius. Grouse were seldom found in the denser cover types, i.e., riparian and mountain shrub habitats. However, they used these cover types as escape cover in 77% of the cases where the landing site of a flushed radioed bird was observed ($N = 338$).

Microhabitat Selection

Mean distance to water did not differ significantly between flush ($\bar{x} = 297.6 \pm 183.3$ m) and random ($\bar{x} = 295.9 \pm 211.7$ m) sites ($P < .40$), and no evidence was found that Sharp-tailed Grouse sought free water. The range of slopes

TABLE 1. Summer habitat use-availability analysis showing the number of radio-tagged Columbian Sharp-tailed Grouse using the major cover types more than (+), less than (−), or in proportion to (NS)[a] that expected by chance[b], 1983–85.

	Home range				1.2-km fixed radius		
Cover types	+	−	NS		+	−	NS
Upper dancing ground							
Big sagebrush	2	0	3		0	0	5
Low sagebrush	0	1	4		0	0	5
Shrubby eriogonum	0	5	0		0	5	0
Mountain shrub	1	0	4		1	0	4
Number of grouse				$N = 5$			
Lower dancing ground							
Big sagebrush	7	0	2		8	0	1
Low sagebrush	0	3	6		0	1	8
Intermediate wheatgrass	0	2	7		0	6	3
Number of grouse				$N = 9$			
Total number of grouse				$N = 14$			

[a]Not significant.
[b]$P \leq .05$.

used by grouse was 0–47%. Grouse used three classes of slope intervals (0–9%, 10–29%, >30%) in proportion to their availability, with >95% of the use occurring on slopes <30% (Marks and Marks 1987a).

Grouse did not show a strong preference for sites that were close to mountain shrub or riparian vegetation except in 1985, the drought year. The mean distance to mountain shrub and riparian habitats measured at flush sites ($\bar{x} = 151.5 \pm 156.5$ m) was farther than that measured at random sites ($\bar{x} = 120 \pm 99.7$ m) in 1983 and 1984 (Mann-Whitney U-test $P < .04$) but significantly closer (flush sites, $\bar{x} = 84.4 \pm 90.9$ m) in 1985 ($P < .0001$).

Vertical cover measured at random sites differed significantly among cover types (Kruskal-Wallis $P < .001$). Mean cover board readings indicated that the bitterbrush cover type provided the greatest cover; big sagebrush, intermediate wheatgrass, and low sagebrush types provided intermediate cover; and eriogonum sites had very little cover (Fig. 1). A drought during 1985 resulted in significantly less vertical cover in 1985 than in 1984 (Mann-Whitney U-test $P < .01$). However, the rank order of cover availability was the same among all cover types except intermediate wheatgrass, which decreased substantially in 1985.

Eighty-three percent of the flush sites for which microhabitat measurements were taken occurred in big and low sagebrush cover types. Vegetative data on microsite use vs. availability were evaluated only for big and low sagebrush cover types because sample sizes were too small for the other types.

Vertical cover measured at flush sites differed among years within big and low sagebrush cover types (Kruskal-Wallis $P < .05$). As noted at random sites, there was significantly less cover in 1985 than in 1984. A comparison of grouse flush sites with random sites revealed that grouse selected denser cover than that measured at random sites (Fig. 1).

The cover types used most by grouse, big and low sagebrush, had a higher diversity of shrub, forb, and grass species than the other cover types (Fig. 2). The big sagebrush cover type had the highest diversity of shrubs and grasses, and the low sagebrush cover type had the highest diversity of forbs. Overall, the big sagebrush cover type had the highest structural heterogeneity (measured as the coefficient of variation of canopy coverage and cover board readings).

During 1983–85, canopy coverage of shrubs at grouse flush sites averaged about 9% in both big and low sagebrush cover types. Forb coverage averaged about 30%, and grasses ranged from 28% to 32% canopy coverage in low sagebrush and big sagebrush cover types, respectively. Overall, canopy coverage at flush sites was significantly greater than at random sites due largely to greater total forb coverage at flush sites (Table 2). Conversely, percentage of bare ground was less at flush sites than random sites in all cases (Table 2). Sites chosen by grouse in 1984 and 1985 had significantly higher arrowleaf balsamroot cover than did random sites. There was significantly higher canopy

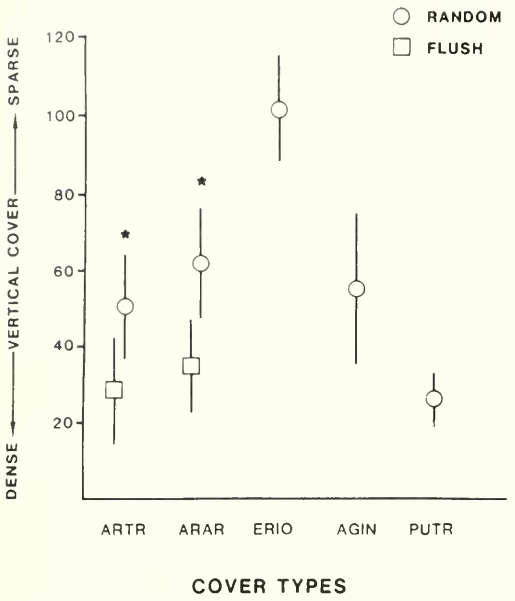

Fig. 1. Mean (± SD) cover board readings at random sites and Sharp-tailed Grouse flush sites in the major cover types (big sagebrush [ARTR], low sagebrush [ARAR], shrubby eriogonum [ERIO], intermediate wheatgrass [AGIN], bitterbrush [PUTR], 1984–85 (* = $P < .001$). Vertical axis represents the number of boxes visible on the cover board (see Methods).

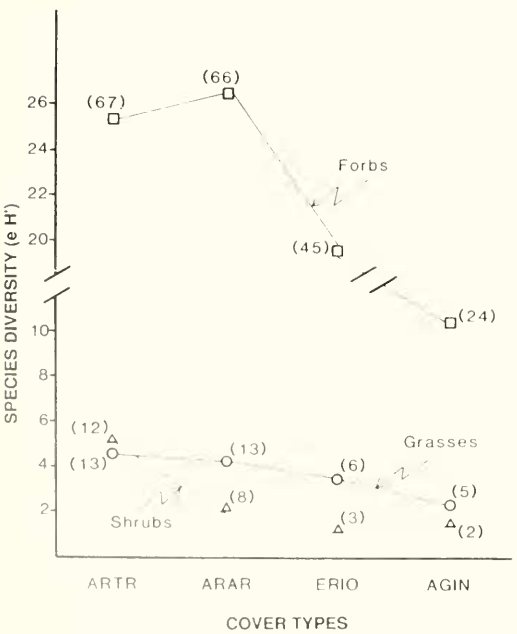

Fig. 2. Plant species diversity ($e^{H'}$) at random sites for shrubs, forbs, and grasses in the major cover types (big sagebrush [ARTR], low sagebrush [ARAR], shrubby eriogonum [ERIO], intermediate wheatgrass [AGIN]), 1984–85. The total number of plant species sampled in each cover type is in parentheses.

coverage of bluebunch wheatgrass at grouse flush sites than at random sites in the big sagebrush cover type in 1984 and in the low sagebrush cover type in 1985.

Canopy coverage at grouse flush sites in the big sagebrush type differed among years in five of six vegetative categories (Fig. 3). Bare ground increased while bulbous bluegrass, other forbs, and other composites decreased during the drought of 1985 as compared to 1983 and 1984. However, bluebunch wheatgrass increased in 1985, while the cover of arrowleaf balsamroot was not significantly different among years.

Bluebunch wheatgrass and arrowleaf balsamroot are native perennials that are considered decreaser species (Blaisdell and Pechanec 1949, Evans and Tisdale 1972); i.e., they typically decrease or are eliminated under heavy livestock grazing (Dyksterhuis 1949). Canopy coverage of decreaser forbs was significantly greater at flush sites than at random sites in the big and low sagebrush cover types (Marks and Marks 1987a).

Discussion

Summer home ranges for this subspecies in Colorado (Giesen 1987) and for other subspecies (Artman 1970, Christenson 1970, Ramharter 1976, Gratson 1983) were smaller than we observed in this study. Differences in home range size were probably a reflection of habitat condition; larger home ranges were observed in western Idaho, where decreaser forbs were limited and historic livestock grazing apparently had a greater influence on the vegetation.

From spring to fall, >90% of all grouse locations were within 1.2 km of a dancing ground. Similarly, locations of Sharp-tailed Grouse in other studies were within 1.0 and 2.5 km of dancing grounds (Pepper 1972, Oedekoven 1985, Giesen 1987, Nielsen and Yde 1982). These results suggest that maintaining habitats within 2.5 km of dancing grounds will provide summer habitat requirements for Sharp-tailed Grouse.

Compared with other cover types, big sagebrush sites had a high diversity of shrubs, forbs, and grasses; the highest structural diversity; and the greatest canopy coverage of perennial bunchgrasses. The sharptails' overall preference for the big sagebrush cover type indicated that they likely selected for habitat diversity relative to surrounding areas.

TABLE 2. Mean canopy coverage (%) of vegetative categories in big sagebrush (ARTR) and low sagebrush (ARAR) cover types at Columbian Sharp-tailed Grouse flush sites vs. random sites.

	Year							
	1984				1985			
	ARTR		ARAR		ARTR		ARAR	
Vegetative category	Flush (107)[a]	Random (42)	Flush (21)	Random (24)	Flush (107)	Random (42)	Flush (21)	Random (24)
Big sagebrush	3.43	4.03[b]	0.02	0.07	4.97	6.52[b]	0.22	0.33[b]
Low sagebrush	0.21	0.49[b]	5.45	7.84	0.55	0.79[b]	7.03	7.88
Bitterbrush	1.52	1.02	0.86	0.17	2.76	1.84[b]	1.15	0.88
Other shrubs	1.73	0.89	0.14	0.59[b]	2.21	2.69[b]	1.36	0.40
Total shrubs	6.89	6.43	6.47	8.67	10.49	11.84	9.76	9.49
Arrowleaf balsamroot	13.60	6.55[b]	12.21	3.91[b]	13.06	7.40[b]	11.91	5.28
Other composites	7.05	3.78[b]	5.14	2.95[b]	2.90	3.33	3.02	3.19
Other forbs	12.76	15.31[b]	12.83	14.24	9.70	7.87	14.97	7.22
Total forbs	33.40	25.64[b]	30.18	21.10[b]	25.66	18.60[b]	29.90	15.69
Bluebunch wheatgrass	2.93	2.56[b]	1.02	0.85	5.18	2.91	4.72	0.46[b]
Bulbous bluegrass	35.87	24.59[b]	36.83	23.09	15.97	16.52	13.20	22.33[b]
Other grasses	3.76	4.32	2.52	3.32	3.01	2.02	3.33	3.29
Total grasses	42.56	31.47	40.37	27.26	24.16	21.45	21.25	26.08[b]
Bare ground	23.93	35.93[b]	28.05	42.30[b]	40.23	48.62[b]	39.31	48.94[b]

[a]Sample size (number of transects conducted in each type).
[b]Indicates significant difference ($P < .05$) in mean canopy coverage between flush and random sites within cover types.

Shrubby eriogonum sites, which were strongly avoided by grouse, contained a low diversity of forbs, and even in the absence of grazing provided little cover. Excluding dancing grounds, Sharp-tailed Grouse studied elsewhere have exhibited similar selection against areas of sparse cover (Pepper 1972, Ziegler 1979, Klott and Lindzey 1990). The intermediate wheatgrass cover type also was avoided by grouse. Grouse were particularly absent from intermediate wheatgrass during years with relatively low numbers of grasshoppers.

Mountain shrub, riparian, and bitterbrush habitats were used primarily as escape cover during spring and summer. Beginning in late summer, mountain shrub and riparian plant species produced fruits that became an important part of the grouse diet (Marks and Marks 1987a). Proximity to this shrubby vegetation may not have been critical during early to mid-summer when the cover types preferred by grouse were providing adequate food and cover. Grouse were found closer to mountain shrub and riparian habitat than expected by chance only in the drought year (1985), when vertical cover decreased significantly in all cover types that were measured.

Sharptails apparently selected areas least modified by livestock grazing. Grouse locations were characterized by greater herbaceous cover and less bare ground than random sites. Studies of plant communities with and without grazing indicate that areas with relatively little bare ground are least modified by livestock (see

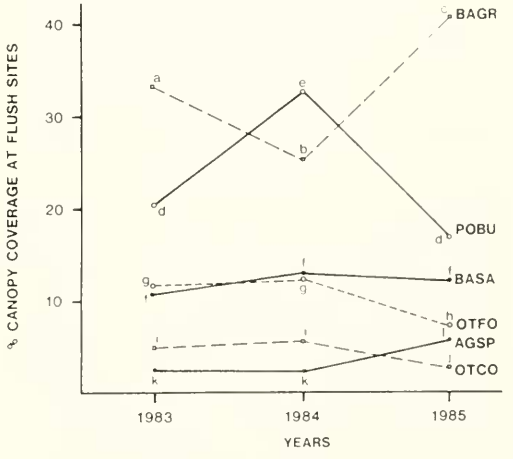

Fig. 3. Comparison of canopy coverage at Sharp-tailed Grouse flush sites in the big sagebrush cover type in western Idaho, 1983–85. On each line different letters indicate that corresponding means are significantly different at $P = .05$. (BAGR = bare ground, POBU = bulbous bluegrass, BASA = arrowleaf balsamroot, OTFO = other forbs, AGSP = bluebunch wheatgrass, OTCO = other composite forbs.)

Holechek et al. 1989). When compared with random sites, grouse locations had significantly higher proportions of forb species that decrease from overgrazing (Dyksterhuis 1949). In particular, grouse preferred microhabitats with greater abundances of arrowleaf balsamroot and bluebunch wheatgrass, two plant species that typically decline with overuse by livestock grazing (Blaisdell and Pechanec 1949, Evans and Tisdale 1972, Mueggler and Stewart 1980). These native perennials are major components of later seral stages (Hironaka et al. 1983).

The presence of arrowleaf balsamroot and bluebunch wheatgrass as cover plants during a drought year is especially noteworthy. These plants are particularly drought resistant (Tisdale and Hironaka 1981, Wasser 1982). Bulbous bluegrass, the most abundant and widespread grass in the study area, is an introduced perennial with root systems that die each year; it is virtually nonexistent during years of low moisture (Monsen and Stevens, in preparation). Indeed bulbous bluegrass contributed lower cover values in 1985 than in 1983 and 1984 (years with average moisture) (Table 2). In contrast, cover of bluebunch wheatgrass was similar among those years. In the absence of native perennials, grouse would not have had as much cover during drought years. The loss of these important cover plants may have contributed to the disappearance of Columbian Sharp-tailed Grouse from large portions of their historic range.

Conclusions and Management Implications

Given the widespread decline of the Columbian Sharp-tailed Grouse and the fragmented nature of extant populations, conservation of all potential sources of genetic variation should be a critical concern to managers. Maintenance of shrubsteppe communities in advanced seral stages is especially important for conservation of summer habitat in the Intermountain region.

Habitat features that characterize occupied habitats in western Idaho are flat to rolling rangeland in relatively good condition with a diversity of native shrubs, forbs, and grasses. Native perennials arrowleaf balsamroot and bluebunch wheatgrass are critical for cover during a drought year. Also important is riparian vegetation and numerous patches of mountain shrubs for escape cover and late summer food. These habitat characteristics suggest that Columbian Sharp-tailed Grouse are an indicator of good range condition in the mesic shrubsteppe of the Intermountain region.

Federal land management agencies are directed to conserve candidate species and their habitats and to avoid actions that may cause the species to become listed as federally threatened/endangered. Conservation efforts for Columbian Sharp-tailed Grouse, a candidate species, must include protection and enhancement of habitats that are occupied by the subspecies throughout their range, especially disjunct populations in jeopardy of extirpation. The success of attempts to improve their current status is dependent on reducing disturbances that may damage the natural diversity of shrubsteppe habitat (e.g., overgrazing by livestock and agricultural development).

Protecting habitats within 2.5 km of dancing grounds is critical for maintainence of summer habitat. Suitable habitats for reestablishment within their historic range need to be identified. However, reestablishment efforts for this native species should not take precedence over preservation and restoration of habitats that currently support sharptails (cf. Griffith et al. 1989).

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